cofc

09/996318

Certificate of Mailing

I hereby certify that this correspondence is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: June 3, 2005

Sonia V. McVean

PATENT
6,837,778

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Sadahiko KONDO et al. Patent No.: 6,837,778 Date of Patent: January 4, 2005 Title: METHOD FOR CUTTING RARE EARTH ALLOY, METHOD FOR MANUFACTURING RARE EARTH MAGNET, AND WIRE-SAW MACHINE	Art Unit: 3723 Examiner: E. Ojini Certificate JUN 14 2005 of Correction

REQUEST FOR CERTIFICATE OF CORRECTION

ATTN:
Decisions & Certificates of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

With reference to the above-identified patent, an error has been found in the Letters Patent document. In accordance with the provisions of 37 C.F.R. § 1.322, enclosed is a Certificate of Correction for the above-identified patent. The enclosed Certificate of Correction corrects the error contained in Claim 1 in column 20, line 11 of the patent because the word "faxed" is incorrect. It should be corrected to read --fixed--.

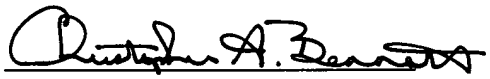
This error is believed to be attributable to the U.S. Patent and Trademark Office, since the last Amendment filed with the U.S. Patent Office on March 21, 2004 clearly includes the word "fixed" in claim 1. Applicants attach hereto a copy of page 20 of Letters Patent No. 6,837,778.

Applicants respectfully request correction of this error by issuance of a Certificate of Correction.

Applicants have not included payment of the $100.00 Certificate of Correction fee because the error is believed to be attributable to the U.S Patent and Trademark Office. The Commissioner is authorized to charge Deposit Account No. 50-1353 for any fee shortages.

Respectfully submitted,

Date: June 3, 2005



Attorney for Applicant(s)
Christopher A. Bennett
Reg. No. 46,710

KEATING & BENNETT, LLP
10400 Eaton Place
Suite 312
Fairfax, VA 22030
Tel: (703) 385- 5200
Fax: (703) 385-5080

PTO/SB/44 (04-05)
Approved for use through 04/30/2007. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,837,778 B2

APPLICATION NO.: 09/996,318

ISSUE DATE : January 4, 2005

INVENTOR(S) : Kondo et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 20, line 11, "faxed" should be changed to --fixed--.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

KEATING & BENNETT, LLP
10400 Eaton Place, Suite 312
Fairfax, VA 22030

the wire **20** travels in alternate directions, a strong tension is generated to the wire **20** when the traveling direction is reversed.

The number of times of snapping of the wire was evaluated using the wire-saw machine **100** for sets of the rollers **10***a*, **10***b*, and **10***c* different in the tilt angle of the slopes **10**S. A polyurethane rubber layer was used as the polymer layer **10**P, and an aqueous solution of about 10% of Yushiro #830 was used as the coolant. Workpieces of the rare earth sintered magnet used in Embodiment 1 were cut continuously for 300 hours, and the number of times the wire **20** snapped during this operation was measured. The results are shown in Table 1 below as the relationship between the tilt angle of the slope **10**S and the number of times of snapping.

TABLE 1

Tilt angle of slope (degree)	30	40	50	55	60	65	70	80
Number of times of snapping	12	11	3	3	3	3	4	5

As is found from Table 1, the number of times of snapping is reduced by setting the tilt angle of the slopes **10**S of the guide groove **10**G at 50 degrees or more. This is presumably because the torsion applied to the wire **20** due to friction between the slopes **10**S and the wire **20** decreases when the tilt angle is 50 degrees or more. The number of times of snapping tends to slightly increase when the tilt angle is 70 degrees or more, presumably because the discharge efficiency of sludge decreases. From the results of this experiment, it is found that the tilt angle of the slopes **10**S of the guide groove **10**G is preferably in the range between 50 degrees and 80 degrees, more preferably in the range between 50 degrees and 65 degrees. If the tilt angle exceeds 80 degrees, the possibility that the wire **20** comes off the guide groove **10**G increases. The guide groove **10**G preferably has a curved bottom **10**B having a radius of curvature slightly smaller than the radius of the wire **20**.

The number of times the wire **20** snaps also depends on the tension of the wire **20** traveling between the rollers. Table 1 above shows the results obtained when the tension of the wire **20** is 30 N. Substantially the same re-suits are obtained when the tension of the wire **20** is in the range between 25 N and 35 N.

Thus, according to the present invention, provided is the method for cutting a rare earth alloy with the abrasive grain-fixed wire, which can be realized by using a coolant containing water as the main component. Also, according to the present invention, the life of the wire can be made longer by reducing damage to the abrasive grains fixed to the wire and the wire itself. Moreover, according to the present invention, the wire-saw machine suitably used for the cutting method described above is provided.

By employing the cutting method of the present invention, a rare earth alloy can be cut with high machining precision with a smaller cutting margin. Therefore, loss of expensive materials for the rare earth metal alloy can be minimized. In addition, recycling of the coolant can be easily realized, which is friendly to the environment and also decreases the cost for disposal of liquid waste. This permits reduction of the cost for machining the rare earth metal alloy, and thus, realizes low-cost manufacture of cut products of the alloy, such as rare earth magnets used for voice coil motors for positioning a magnetic head.

Although the wire-saw machines **100** and **200** are exemplified in the above Embodiments, the present invention may be applied to an endless-type wire-saw machine which employs a single reel bobbin (see Japanese Laid-Open Patent Publication No. 11-198018, for example).

While the present invention has been described in a preferred embodiment, it will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than that specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the invention that fall within the true spirit and scope of the invention.

What is claimed is:

1. A method for cutting a rare earth alloy using a wire with abrasive grains faxed to a core wire, comprising the step of:

cutting the rare earth alloy with the wire traveling in a state that a portion of the rare earth alloy to be cut with the wire is immersed in a coolant containing water as the main component, the coolant having a surface tension at 25° C. in a range of 25 mN/m to 60 mN/m.

2. The method according to claim **1**, wherein the coolant contains a water-soluble synthetic lubricant and water in a weight 10 times to 50 times as large as the weight of the synthetic lubricant.

3. The method according to claim **1**, wherein the coolant contains a surfactant and water in a weight 10 times to 50 times as large as the weight of the surfactant.

4. The method according to claim **1**, wherein the coolant contains an antifoaming agent.

5. The method according to claim **1**, wherein the coolant has a pH of 8 to 11.

6. The method according to claim **1**, wherein the coolant contains an anticorrosive.

7. The method according to claim **1**, wherein the abrasive grains are fixed via a resin layer formed on the outer circumference of the core wire.

8. The method according to claim **1**, wherein the average distance between the adjacent abrasive grains in a direction of travel of the wire is in a range of 150% to 600% of the average particle size of the abrasive grains, and the average height of portions of the abrasive grains protruding from the surface of the resin layer is in the range of 10 μm to 40 μm.

9. The method according to claim **1**, wherein the average particle size D of the abrasive grains satisfies the relationship 20 $\mu m \leqq D \leqq 60$ μm.

10. The method according to claim **1**, wherein in the step of cutting, the portion of the rare earth alloy to be cut with the wire is immersed in the coolant contained in a reservoir, and the coolant is supplied into the reservoir from the bottom of the reservoir and also from an opening of the reservoir, so that the coolant is kept overflowing from the opening.

11. The method according to claim **10**, wherein in the step of cutting, the amount of overflow of the coolant per minute is 50% or more of the volume of the reservoir.

12. The method according to claim **10** wherein in the step of cutting, the amount of the coolant supplied from the opening is greater than the amount of the coolant supplied from the bottom.

13. The method according to claim **10**, wherein in the step of cutting, curtain-like flows of a gas or the coolant are formed above the sides of the opening of the reservoir crossing the wire travel direction, so that the coolant is suppressed from overflowing from the opening of the reservoir.

14. The method according to claim **1**, wherein the wire is driven by a roller, the roller includes a polymer layer having a guide groove formed therein, the guide groove has a pair of slopes at least one of which has an angle of 50 degrees or more with respect to the surface of the roller, and the wire travels along a space between the pair of slopes.

15. The method according to claim **1**, wherein the rare earth alloy is a R—Fe—B rare earth sintered alloy.